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2.46. Kennett plate, No. 6.
2.52. Ditto " 7.
3.30. Ditto " 8.
3.34. Ditto " 9.
Small spot very close to Sun's edge.
Clouds and mist then came on.
5.25. Sun low ; disk clear.

Friday, 23rd *March.*

6.58.
7.28.
7.55.
8.7.
8.47.
9.30.
10.0.
Sharp frost ; Sun rose in slight mist, which afterwards got denser ; disk, however, well seen and quite clear.
10.18. Misty ; fine Sun halo.
10.30. Disk clear.
11.0. Mist ; wind freshening.
11.7. Disk clear.
11.38. Mist and wind ; clouds coming up.
11.50. Clearer again.
12.33. Bright gleam ; disk well seen and quite pure.
1.0. Glimpse among clouds.
1.45. Same.
1.48. Very bright glimpse.
2.52. Disk well seen through mist.
3.48. Same (with 20).
4.40. Sun in cloud and mist, but disk fairly seen with 20 ; wind high.
5.10. Fine Sun halo and Sun set in clouds.

Guildown, Guildford,
April 4, 1877.

Radiant Points of Shooting Stars. From Captain Tupman's unreduced Observations 1869–71.

By W. F. Denning, Esq., F.M.S.

(*Communicated by A. C. Ranyard, Esq., M.A.*)

The valuable observations of Shooting Stars by Captain Tupman in the years 1869–70–71, printed in 1873 for the British Association, contain a considerable number of meteor-paths that have not hitherto been reduced to their radiant points. Thus, between Jan. 21–Feb. 23 (1869) there are about 135, between Sept. 6–Oct. 13 (1869–71) 130, and between Dec. 12–23 (chiefly in 1869) 40 more, making about 300 altogether. These

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I have projected upon an 18-inch globe, and traced their several radiant centres, as specified in the subjoined list of 20 such positions well-ascertained, and supplementary list of 8 others less certainly indicated. I have annexed the positions of other observers which they confirm, and the comparison shows that there is a very fair accordance in most cases. It should be mentioned that these new determinations are purely independent of and separate from Captain Tupman's older positions (*Monthly Notices*, vol. xxxiii. p. 300), having been deduced from other meteors seen on other nights; in fact, they are founded on different materials, though gathered by the same hand, and the two sets of positions compared together in the table, each possess a distinct value, whether confirmatory or otherwise. The chief shower in the new list is No. 2 at α 236° δ +11° (near α *Serpentis*) for Jan. 21–Feb. 23, which this year I confirmed in the same place, and was well observed by Captain Tupman Feb. 13, 1869, at 237° +13°. Nos. 11 and 16 were also active radiants. No. 13 (Sept.) at 105°+53° is not included in existing catalogues, though I found a position at 90° +58° for Oct. (No. 29 of my list [1876] of radiants, *Monthly Notices*, vol. xxxvii. p. 105). The average of the two comes out at 98°+56°, which is suspiciously near the radiant point of Donati's Comet (100° +59° Sept. 8) as computed by Professor Herschel (*see* B.A. Report, 1875, p. 233)*. Capt. Tupman describes the meteors as "very swift," and I find his estimate of the apparent velocity of 9 of them averaged 0·2 sec. for 10 degrees. I found them bright and rapid, leaving streaks. The fourth radiant in the supplementary list verifies a new and prominent shower I saw from near ψ *Cygni* in January last, and since confirmed by Prof. Heis at 297°+53° Jan. 1–21.

The shooting stars employed in the determination of these radiants do not include the *whole* of Capt. Tupman's unreduced paths. Between Nov. 3–12, 1869, there are 80 such observations, and in August 1870 a few more; but I have not gone over them, inasmuch as the chief systems (*Leonids* and *Taurids* in the former, and *Perseïds* and *Cassiopeïds* in the latter) common to those periods are already thoroughly well known by the able investigations of Mr. Greg and Prof. Herschel, of the British Association Luminous Meteor Committee.

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* Since the above was written, I have examined many hundreds of meteor-paths recorded between Aug. 15–Oct. 15 by Capt. Tupman, Mr. Lucas (Radcliffe Observatory, Oxford), the Italian observers (Schiaparelli, Denza, and others, 1872), and myself, and found 33 meteors agreeing to a radiant at 99° + 57° for September 1–15; while for the whole two months I have double that number from a general centre at 101° + 57°. The accordance of this new shower in date and position with the nodal passage of Donati's Comet is remarkable, though possibly accidental and showing no real affinity of origin. —W. F. D.

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List of 20 *Radiant Points of Shooting Stars, deduced from Captain Tupman's Observations,* 1869–71, *not previously utilised.*

	No. T. & D. 1877.	No. Tupman. 1873.	No. Greg. 1874.	Radiant-Point (T. & D. 1877). R.A. °	Dec. °	No. of √s	Confirmations and Comparisons. T. (Tupman), G. and H. (Greg and Herschel), S. (Schmidt), S. and Z. (Schiaparelli and Zezioli), N. (Neumayer), H. (Heis), D. (Denning).
Jan. 21 to Feb. 23.	1	16–21	27	261	+ 4	8	T. 260° ± 0°, Feb. 13; T. 266° + 6° March 14–15.
	2	10	41	236	+ 11	20	T. 237 + 13, Feb. 13; D. 236 + 11, Feb.
	3	23	41	245	− 22	9	T. 236 − 13, March 2–3; T. 233 − 18, March 7.
	4	11–17	44	209	− 27	10	T. 204 − 31, March 11–19; T. 202 − 28, March 19.
	5	15	53	228	− 4	8	T. 230 − 7, Feb. 13; G. and H. 227 − 5, March–May.
	6	11–13	20	188	− 26	8	T. 198 − 22, Feb. 3–10; T. 180 − 20, Feb. 8–10.
	7	6	8	204	− 10	10	T. 202 − 9, Feb. 13; T. 200 − 10, March 2–3.
	8	17	44	218	− 37	8	T. 217 − 41, Feb. 22; N. 192 − 38, March.
	9	2	28	174	+ 13	5	T. 175 + 16, Feb. 3–10; G. and H. 175 + 10, Feb.–March.
	10	10–25 ?	18	228	+ 29	11	G. and H. 233 + 34, Jan. 28–29; D. 234 + 32, Jan.–Feb.
Sept. 6 to Oct. 4 (chiefly).	11	78	138 164	59	− 9	13	T. 54 − 14, Oct. 5–6; S. 55 − 6, Sept. Eridanids.
	12	79	157	90	+ 19	8	T. 91 + 18, Oct. 17; S. 93 + 17, Oct. Orionids.
	13	...	...	105	+ 53	10	D. 90 + 58, Oct. 14–15; new shower?
	14	68–69	114	50	+ 46	10	T. 45 + 48, Sept. 5; S. 50 + 48, Aug. 3–12.
	15	...	109	340	− 14	7	S. 331 − 13, Aug.–Sept.; N. 347 − 11, Oct.
	16	93	150	28	+ 12	12	S. 22 + 5, Aug.–Sept.; D. 27 + 11, Sept.–Oct.
	17	75	115 117	54	+ 16	8	T. 62 + 9, Sept. 14; S. 51 + 14, Sept.
	18	82–80	155 153	113 98	+ 11 − 10	10	T. 107 + 12, Oct. 8 T. 92 − 14, Oct. 12 } T. 101 ± 0, Oct. 16.
	19	62	121	24	+ 36	8	T. 23 + 36, Aug. 23; H. 23 + 40, Oct.; S. & Z. 28 + 36, Sept. 23; G. and H. 17 − 10, Sept.–Oct.; S. 9 − 15, Aug.
	20	...	133	12	− 12	7	

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The above are the best positions. The following radiants were also clearly marked, though apparently more inactive, and therefore less reliable, than the preceding.

Date.	No. T.	No. G.	Radiant Point.		No. of ↙ s	Confirms
			°	°		
Feb.	...	54	180	+27	5	D. 186 +24, Feb. Distinct to G. 11?
Feb.	...	188?	120	− 5	4	D. 117 −7, Feb. New shower?
Feb.	2	5	168	+ 4	5	D. 168 +4, Feb. Allied to No. 9?
Jan.–Feb.	...	...	295	+51	5	D. 295 +53, Jan. (20 ↙ s). Fine new shower.
Sept.–Oct.	72	133?	76	+ 9	6	T. 75 +15, Sept. 22. Allied to No. 17?
Sept.	...	193	44	+77	5	G. and H. 47 +74, Sept.
Dec. 12–17	...	162	66	+69	5	D. 69 +66, Dec. Active shower. S. 66 +65, Nov.
Dec. 12–23	...	180 183 ?	53	+ 3	5	S. 55 +5, Dec.; Clark 57 +6, Dec. 10–12.

Slight radiation also from about 118° +29° (Oct.), 344° +54° (Dec.), and 33° +21° (Dec.).

Bristol, April 7, 1877.